PATENT ABSTRACTS OF JAPAN

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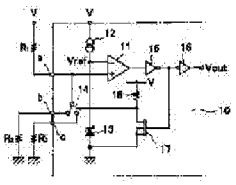
(54) VOLTAGE DETECTOR FOR SECONDARY BATTERY AND SECONDARY BATTERY DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a voltage detector made into an integrated circuit capable of easily setting a shut-down detection voltage and a restoration detection voltage corresponding to a secondary battery.
SOLUTION: This voltage detector is provided with voltage dividing resistors R1-R3 for voltage-dividing the battery voltage of the secondary battery by a prescribed voltage dividing ratio, a comparator 11 for comparing a detection voltage obtained through the voltage dividing resistors R1-R3 with a prescribed reference voltage and a voltage dividing ratio control means for charging the voltage dividing ratio of the voltage dividing resistors R1-R3 corresponding to the output of the comparator 11 and imparting hysterisis characteristics to the comparator 11. Especially, the voltage dividing resistors R1-R3 are turned to discrete components externally attached to a voltage detector body 10 made into the integrated circuit with the comparator 11 and the voltage dividing ratio control means as a subject and the resistance value is easily adjusted. Also, the voltage detector body 10 made into the integrated circuit is shared by the various secondary batteries.

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examiner's decision of rejection]

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* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The comparator which compares the partial pressure resistance which pressures the cell voltage of a rechargeable battery partially by the predetermined division ratio with the detection electrical potential difference called for through this partial pressure resistance and predetermined reference voltage, The division-ratio control means which changes the division ratio of said partial pressure resistance according to the output of this comparator, and gives a hysteresis characteristic to said comparator is provided. Electrical-potential-difference detection equipment of the rechargeable battery characterized by using said partial pressure resistance as the discrete part by which external is carried out to the body of electrical-potential-difference detection equipment integrated-circuit-ized by making said comparator and a division-ratio control means into a subject.

[Claim 2] Rechargeable battery equipment characterized by coming [package]-

izing [the electrical-potential-difference detection equipment of a rechargeable battery according to claim 1 / this rechargeable battery and one].

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the electrical-potential-difference detection equipment of a suitable rechargeable battery to be integrated-circuit-ized and detect the charge electrical potential difference of the rechargeable battery of a specification variously, and the rechargeable battery equipment which package-ized this electrical-potential-difference detection equipment with the rechargeable battery.

[0002]

[A related background technique] Recently, rechargeable batteries, such as a lithium ion battery and a nickel hydoride battery, have come to be briskly used as an internal electrical power source in electronic equipment, such as a notebook mold personal computer and a portable telephone. Moreover, the rechargeable battery equipment which package-ized the fuel-level-indicator (FG) circuit which

controls the charge and discharge of a rechargeable battery by recently to this rechargeable battery and one is variously developed as the so-called cell pack.
[0003] There is electrical-potential-difference detection equipment used for one of the important functions in this kind of fuel-level-indicator circuit under supervising the charge electrical potential difference of a rechargeable battery at too much charge-and-discharge preventive measures of this rechargeable battery. Fundamentally, when the charge and discharge voltage of a rechargeable battery results in a shutdown electrical potential difference, this electrical-potential-difference detection equipment carries out off actuation of the switch (for example, FET) which detects this and controls the charge and discharge of said rechargeable battery, and plays the role which prevents the superfluous charge and discharge of this rechargeable battery by this.
[0004] When a rechargeable battery incidentally recovers the above-mentioned shutdown electrical potential difference and this is detected on the same level as a shutdown, there is a possibility that said rechargeable battery may return to a shutdown electrical potential difference again with ON actuation of the switch for said charge-and-discharge control. The electrical-potential-difference detection property of having the hysteresis of predetermined width of face is set to this reason and said electrical-potential-difference detection equipment so that a difference may generally be given to a shutdown detection electrical potential difference and a return detection electrical potential difference and the charge and discharge voltage of said rechargeable battery may be detected that is,.
[0005]
[Problem(s) to be Solved by the Invention] By the way, if it is based on viewpoints, such as the dependability, mounting cost, etc., when package-izing to one the electrical-potential-difference detection equipment mentioned above and realizing rechargeable battery equipment (cell package) with a rechargeable battery, it is desirable to integrated-circuit-ize said electrical-potential-difference detection equipment, for example, as shown in drawing 4 , circuitry will be carried out and it will be integrated-circuit-ized.

[0006] Explanation of the electrical-potential-difference detection equipment shown in this drawing 4 constitutes this electrical-potential-difference detection equipment considering the comparator 1 which operates considering the cell voltage Vbat of a rechargeable battery as a power source as a subject. And while giving the reference voltage Vref generated by the inversed input terminal (-) of a comparator 1 from said cell voltage Vbat with a constant current source 2 and reference diode 3, said cell voltage Vbat was supervised by giving the comparison electrical potential difference which pressured said cell voltage Vbat partially by the partial pressure resistance R1, R2, and R3 connected to the serial to the non-inversed input terminal (+) of said comparator 1, and comparison detection of this has been carried out.

[0007] Incidentally, the above-mentioned comparator 1 makes it flow through the n channel mold FET 4 and the p channel mold FET 5 which are connected and formed in a serial between power sources with the output, and make a driver circuit alternatively, and it is constituted so that the p channel mold FET 6 for an output may be made to turn on and off by this. Coincidence is made to turn on and off the p channel mold FET 7 for hysteresis control with the output, and the division ratio to said cell voltage Vbat is changed in short-circuiting said partial pressure resistance R3 alternatively by this.

[0008] By the way, in the electrical-potential-difference detection equipment integrated-circuit-ized by doing in this way, the shutdown detection electrical potential difference which is the operating characteristic and which was mentioned above, its return detection electrical potential difference, as a result the width of face of a hysteresis are naturally determined by the value of said partial pressure resistance R1, R2, and R3. However, the optimal shutdown detection electrical potential difference and its optimal return detection electrical potential difference for a rechargeable battery change with properties of a rechargeable battery. A rechargeable battery is especially realized as a cell block which connected further implementation ****** or two or more cell cels to juxtaposition at the serial as a cell cel (unit cell) cell classification not only being

determined according to the specification but single. It was difficult for it to be necessary to develop separately this reason and the electrical-potential-difference detection equipment according to the specification of a rechargeable battery with which the operating characteristic was integrated-circuit-ized, or to prepare beforehand two or more sorts of integrated-circuit-ized electrical-potential-difference detection equipments with which operating characteristics differ, and to choose and use this, and to common-use-ize it, using electrical-potential-difference detection equipment as an integrated circuit.

[0009] This invention was made in consideration of such a situation, and the purpose is in offering the integrated-circuit-ized electrical-potential-difference detection equipment which can be set up simply according to the rechargeable battery of a specification about the shutdown detection electrical potential difference and a return detection electrical potential difference variously. Moreover, this invention is to offer rechargeable battery equipment with the high stability of operation which package-ized such electrical-potential-difference detection equipment to a rechargeable battery and one.

[0010]

[Means for Solving the Problem] The electrical-potential-difference detection equipment of the rechargeable battery built over this invention in order to attain the purpose mentioned above The comparator which compares the partial pressure resistance which pressures partially the cell voltage of the above-mentioned rechargeable battery by the predetermined division ratio with the detection electrical potential difference called for through this partial pressure resistance and predetermined reference voltage, It has the division-ratio control means which changes the division ratio of said partial pressure resistance according to the output of this comparator, and gives a hysteresis characteristic to said comparator. It is characterized by using especially said partial pressure resistance as the discrete part by which external is carried out to the body of electrical-potential-difference detection equipment integrated-circuit-ized by making said comparator and a division-ratio control means into a subject.

[0011] Moreover, the rechargeable battery equipment concerning this invention package-izes the electrical-potential-difference detection equipment constituted as mentioned above to the rechargeable battery of various specifications, and one, and is characterized by coming to set up the shutdown detection electrical potential difference according to the engine performance and return detection electrical potential difference of this rechargeable battery. That is, this invention is characterized by to common-use-ize variously the body of electrical-potential-difference detection equipment which adjusts the resistance simply, acquires it and integrated-circuit-izes it to the rechargeable battery of a specification by using the partial pressure resistance for setting up the shutdown detection electrical potential difference and the return detection electrical potential difference to a rechargeable battery as external discrete part to the body of electrical-potential-difference detection equipment integrated-circuit-ized by making a comparator and a division-ratio control means into a subject.

[0012]

[Embodiment of the Invention] Hereafter, the electrical-potential-difference detection equipment of the rechargeable battery built over 1 operation gestalt of this invention with reference to a drawing is explained. Drawing 1 is the outline block diagram of the electrical-potential-difference detection equipment for detecting the shutdown electrical potential difference and its return electrical potential difference of a rechargeable battery, and R1, R2, and R3 are partial pressure resistance which pressures partially and detects the electrical potential difference Vbat of the above-mentioned rechargeable battery. These partial pressure resistance R1, R2, and R3 consists of discrete part by which external is carried out to the business shown below to the body 10 of electrical-potential-difference detection equipment formed into an audit trail circuit, and the circuit board (not shown) in which this body 10 of electrical-potential-difference detection equipment is carried is equipped with it, and it is connected to this body 10 of electrical-potential-difference detection equipment.

[0013] Now, said body 10 of electrical-potential-difference detection equipment is

constituted considering the comparator 11 which operates considering the cell voltage Vbat of a rechargeable battery as a power source, and the division-ratio control means which the division ratio of the cell voltage Vbat by said partial pressure resistance R1, R2, and R3 is changed according to the output of this comparator 11, and gives a hysteresis to the operating characteristic of said comparator 11 as a subject, integrated-circuit-izes these and is realized. That is, a constant current source 12 and reference diode 13 generate a comparator 11 to the inversed input terminal (-) from said cell voltage Vbat, it inputs reference voltage Vref into it, inputs into the non-inversed input terminal (+) the detection electrical potential difference which pressured said cell voltage Vbat partially by said partial pressure resistance R1, R2, and R3, and it is constituted so that these electrical potential differences may be compared.

[0014] Incidentally, said partial pressure resistance R1, R2, and R3 is connected to the terminals a, b, and c for ohms connections prepared in the body 10 of electrical-potential-difference detection equipment, respectively, and said terminals b and c are connected to the contact common of the switch 14 with which the above-mentioned terminal a constitutes said division-ratio control means again at the normally-closed contact and normally open contact of the above-mentioned switch 14, respectively. In addition, this switch 14 is realized as a semi-conductor analog switch which carries out switching operation to a high speed rather than said comparator 11. A deer is carried out, and said partial pressure resistance R1 is connected with said terminal a between the positive electrodes (+) of a rechargeable battery, and said partial pressure resistance R2 and R3 is connected, respectively between said each terminals b and c and negative electrodes (-) of the above-mentioned rechargeable battery.

[0015] Thus, at the time of off actuation of said switch 14, the cell voltage Vbat of said rechargeable battery is V1 =Vbat- {R2/(R1+R2)} by connecting said partial pressure resistance R1, R2, and R3 to said each terminals a, b, and c, respectively.

It is detected by carrying out and is V2 =Vbat- {R3/(R1+R3)} at the time of ON

actuation of said switch 14.
It carries out and is detected. In addition, the above-mentioned part piezo-resistances R2 and R3 are set up as [R2>R3] so that it may mention later, for example.
[0016] The charge-and-discharge control circuit which a deer is carried out, and the output of said comparator 11 is outputted in order as an electrical-potential-difference detecting signal Vout through two steps of inverter circuits 15 and 16, for example, is not illustrated is given. Moreover, the output of the above-mentioned inverter circuit 15 is given to FET17 of a p channel mold which drives said switch 15 alternatively, this FET17 is operated, and the on-off drive of said switch 15 is alternatively carried out by this FET17. In addition, 18 in drawing is the load resistance of the above FET 17.
[0017] According to the electrical-potential-difference detection equipment constituted in this way, when the cell voltage Vbat of a rechargeable battery is higher enough than the shutdown electrical potential difference (initial state), the output of a comparator 11 serves as [H] level, and suppose that said switch 14 is in off operating state by this. In this case, since it is in the condition that said partial pressure resistance R2 was chosen through said switch 14, the cell voltage Vbat of said rechargeable battery is given to the non-inversed input terminal (+) of a comparator 11 as a detection electrical potential difference V1 which the partial pressure was carried out by the partial pressure resistance R1 and R2, and was mentioned above. Since the detection electrical potential difference V1 at this time is higher than said reference voltage Vref, the output of said comparator 11 serves as [H] level, and the initial state mentioned above is set up.
[0018] The cell voltage Vbat falls gradually with discharge of said rechargeable battery from such an initial state, and if the electrical potential difference V1 which a partial pressure is carried out [the electrical potential difference] by said partial pressure resistance R1 and R2, and is detected is less than said reference voltage Vref, by this, the output of said comparator 11 will be reversed

and it will be set to [L] level. Then, in response, the output Vout of this body 10 of electrical-potential-difference detection equipment is reversed on [L] level, and it is detected that the cell voltage Vbat of said rechargeable battery was less than the shunt down electrical potential difference. Moreover, since FET17 which received the output of an inverter circuit 15 in coincidence carries out ON actuation, said switch 14 is promptly switched by this and carries out ON actuation by it.

[0019] With ON actuation of such a switch 14, shortly, the partial pressure of said cell voltage Vbat is carried out by the partial pressure resistance R1 and R3, and it is given to said comparator 11 as a detection electrical potential difference V2 (<V1). therefore -- if said detection electrical potential difference V1 is less than reference voltage Vref and a comparator 11 carries out reversal actuation -- the output -- winning popularity -- a switch 14 -- an instant -- changing -- the above-mentioned detection electrical potential difference V1 -- replacing with -- this detection electrical potential difference V1 -- a value -- since the low detection electrical potential difference V2 will be given to a comparator 11, a comparator 11 is stabilized like the above, where an output is reversed.

[0020] The detection electrical potential difference V2 which joins the non-inversed input terminal (+) of said comparator 11 since a switch 14 is in ON operating state as it mentioned above, even if the cell voltage Vbat of after an appropriate time and a rechargeable battery was recovered gradually and the cell voltage Vbat reached said shunt down electrical potential difference does not exceed said reference voltage Vref, and a comparator 11 does not carry out reversal actuation. However, the cell voltage Vbat of a rechargeable battery is recovered further, if the electrical potential difference V2 which a partial pressure is carried out [the electrical potential difference] by said partial pressure resistance R1 and R3, and is detected exceeds said reference voltage Vref, said comparator 11 will carry out reversal actuation at this time, and that output will serve as [H] level.

[0021] Consequently, the output Vout of the body 10 of electrical-potential-

difference detection equipment is reversed on [H] level, and it is detected that the cell voltage Vbat of said rechargeable battery returned to normal values. Moreover, since said FET17 carries out off actuation with the output of an inverter circuit 15 at coincidence, said switch 14 is promptly switched by this and carries out off actuation by it. And it will replace with said partial pressure resistance R3, circuit connection of said partial pressure resistance R2 will be made again, and detection of the fall which the detection electrical potential difference V1 which pressures partially by these partial pressure resistance R1 and R2, and is detected is given to said comparison 11, and exceeds the shunt down electrical potential difference of the cell voltage Vbat of a rechargeable battery as mentioned above will be performed.

[0022] Therefore, according to the electrical-potential-difference detection equipment constituted as mentioned above, by switching simply the division ratio of the supply voltage Vbat according change of the cell voltage Vbat of a rechargeable battery to the partial pressure resistance R1, R2, and R3 according to the output of a comparator 11, as the transition of operation is shown in drawing 2 , a shutdown detection electrical potential difference and a return detection electrical potential difference can be set up according to an individual, and the hysteresis of predetermined width of face can be given and detected. Since the division ratio of the cell voltage Vbat especially by the partial pressure resistance R1, R2, and R3 can be set up according to an individual as resistance of the discrete part by which external is carried out to the body 11 of electrical-potential-difference detection equipment, it can be adjusted according to the engine performance of a rechargeable battery, and can set the electrical-potential-difference disregard level (a shunt down detection electrical potential difference, return detection electrical potential difference) as arbitration.

[0023] Even if it is a case so that it may face realizing this reason and rechargeable battery equipment (cell pack) and the specification of a rechargeable battery may not become settled Since what is necessary is just to determine the partial pressure resistance R1, R2, and R3 by which external is

carried out to said body 10 of electrical-potential-difference detection equipment according to the property of the rechargeable battery which prepares the body 10 of electrical-potential-difference detection equipment with which the configuration beforehand mentioned above was integrated-circuit-ized, and was finally evaluated and determined Development of this rechargeable battery equipment (cell pack) becomes very easy. Moreover, large compaction of the development cycle can be aimed at. Furthermore, since it is not necessary to prepare the body 10 of electrical-potential-difference detection equipment of a configuration (property) variously and since the body 10 of electrical-potential-difference detection equipment variously integrated-circuit-ized like the above to the rechargeable battery of a specification can be used in common, and development of body of electrical-potential-difference detection equipment 10 situation can also be easy-ized, the effectiveness of being able to aim at reduction of an overall manufacturing cost is done so.

[0024] Moreover, if it is the configuration mentioned above, since external [of the partial pressure resistance R1, R2 and R3] will be carried out to the body 10 of electrical-potential-difference detection equipment, it is possible to change the value of external resistance, for example according to the time of charge of a rechargeable battery and discharge, and to set up separately the detection electrical potential difference and hysteresis band at the time of charge, detection electrical potential difference, and hysteresis band at the time of discharge by this. Corresponding to whether a rechargeable battery is specifically in a charge condition, or it is in a discharge condition, to said partial pressure resistance R2 and R3, parallel connection of the resistance R4 and R5 may be carried out alternatively, respectively, or it may be made to carry out the selection change of the above-mentioned resistance R2 and R3 and the resistance R4 and R5. When realizing rechargeable battery equipment (cell pack) as shown below since it will become unnecessary to prepare two electrical-potential-difference detection equipments the object for the electrical-potential-difference detection at the time of charge, and for the electrical-potential-difference detection at the time of

discharge if it does in this way, it becomes possible to attain simplification of the configuration.

[0025] What is necessary is just to make it constitute, as shown in drawing 3 , in package-izing the electrical-potential-difference detection equipment of the above-mentioned configuration to a rechargeable battery and one incidentally and realizing rechargeable battery equipment (cell pack). That is, the switch 21 which consists of a method FET of the power which controls the charge and discharge, and the resistance 22 for charge and discharge current detection are connected to a serial to a rechargeable battery BAT. With moreover, the temperature sensor 23 which detects temperature, the interior of a rechargeable battery BAT What is necessary is to package-ize to one the microprocessor 25 which controls the fuel cage circuit 24 and its actuation, and the electrical-potential-difference detector 10 further mentioned above, and just to make it constitute rechargeable battery equipment (cell pack). In addition, said fuel cage circuit 24 possesses power switching circuit 24a, current measurement circuit 24b, electrical-potential-difference measurement circuit 24c, 24d of overcurrent protection networks, switch driver 2e, etc., and is constituted. And what is necessary is to measure the charge and discharge current of a rechargeable battery BAT, and its cell voltage, incorporating the cell temperature detected by said temperature sensor 23 through A-D converter 25a in which it was built by the microprocessor 25, and just to constitute rechargeable battery equipment, carrying out the monitor of the cell remaining capacity, so that the charge and discharge may be controlled. Under the present circumstances, said electrical-potential-difference detection equipment 10 controls actuation of the above-mentioned fuel cage circuit 24 or a microprocessor 25 by that output, and plays the role which guarantees that stable actuation.

[0026] under the present circumstances, the sense of the current detected in the above-mentioned fuel cage circuit 24 -- under charge of a rechargeable battery -- or since under discharge can be judged, if it is made to perform change control of resistance mentioned above using that judgment result, it will become possible to

ensure electrical-potential-difference detection according to the charge and discharge of a rechargeable battery only with one electrical-potential-difference detection equipment, as mentioned above.

[0027] In addition, this invention is not limited to the operation gestalt mentioned above. For example, various configurations of the comparator 11 which constitutes the body 10 of electrical-potential-difference detection equipment, and configurations of the division-ratio control means for the partial pressure resistance R1, R2, and R3 are deformable. For example, of course, it is also possible to carry out parallel connection of the partial pressure resistance R1, R2, and R3 mutually, and to constitute so that the division ratio may be replaced with. Moreover, the partial pressure resistance R1, R2, and R3 of predetermined resistance is built in beforehand, and it is also possible to constitute so that the external resistance which received the partial pressure resistance harbored among these can be connected to juxtaposition in series. In addition to this. In the range which does not deviate from the summary, this invention can deform variously and can be carried out. In addition, in the range which does not deviate from the summary, it deforms variously and this invention can be carried out.

[0028]

[Effect of the Invention] As explained above, while comparing with predetermined reference voltage the detection electrical potential difference which pressures the cell voltage of a rechargeable battery partially by the predetermined division ratio at partial pressure resistance, and is called for in a comparator according to this invention It has the division-ratio control means which changes the division ratio of said partial pressure resistance according to the output of this comparator, and gives a hysteresis characteristic to said comparator. Since said comparator and the division-ratio control means are used as the discrete part by which external is carried out to the body of electrical-potential-difference detection equipment integrated-circuit-ized by considering as a subject, said partial pressure resistance The shutdown detection electrical potential difference and return detection electrical potential difference to a rechargeable battery of a

specification can be variously set up simply only by adjusting the above-mentioned part piezo-resistance.

[0029] Since the body of electrical-potential-difference detection equipment integrated-circuit-ized especially can be variously common-use-ized to the rechargeable battery of a specification, development of electrical-potential-difference detection equipment, a rechargeable battery, and the rechargeable battery equipment package-ized to one is easy-ized, and the practically great effectiveness of being able to manufacture cheaply is done so.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The outline block diagram of the electrical-potential-difference detection equipment of the rechargeable battery concerning 1 operation gestalt of this invention.

[Drawing 2] The transition diagram showing the operating characteristic over change of the cell voltage Vbat of the electrical-potential-difference detection equipment shown in drawing 1 .

[Drawing 3] The outline block diagram of the rechargeable battery equipment

(cell pack) constituted by package-izing to one the electrical-potential-difference detection equipment and the rechargeable battery which are shown in drawing 1 .

[Drawing 4] Drawing showing the example of a configuration of the integrated-circuit-ized conventional electrical-potential-difference detection equipment.

[Description of Notations]

BAT Rechargeable battery

R1, R2, and R3 Partial pressure resistance (discrete part)

10 Body of Electrical-Potential-Difference Detection Equipment (Integrated-Circuit-izing)

11 Comparator

12 Constant Current Source

13 Reference Diode (Reference Voltage)

14 Switch

15 Inverter Circuit

16 Inverter Circuit

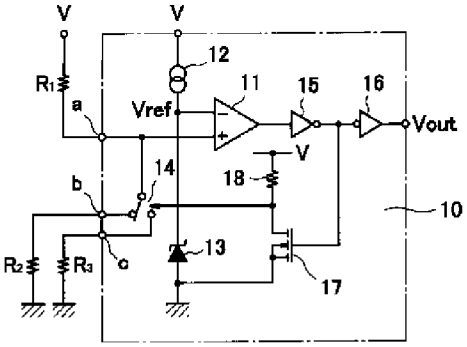
17 FET

18 Load Resistance

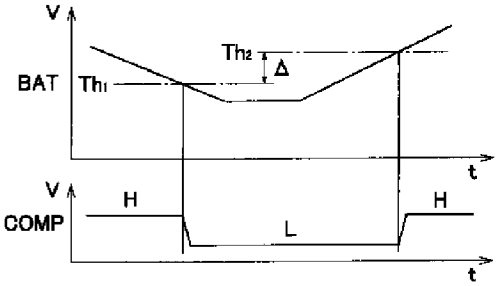
[Translation done.]

DRAWINGS

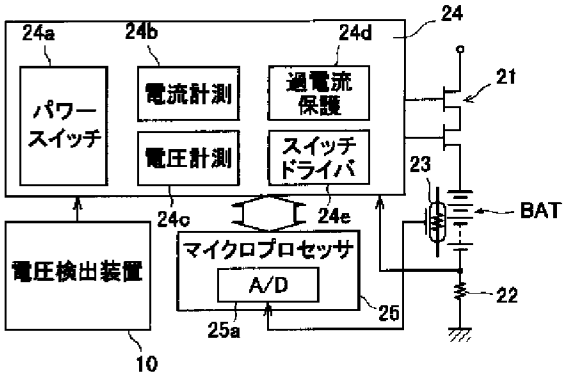
[Drawing 1]



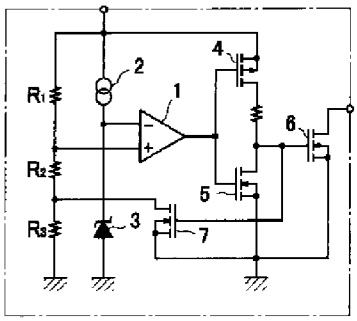
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

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31/36		31/36	Ａ
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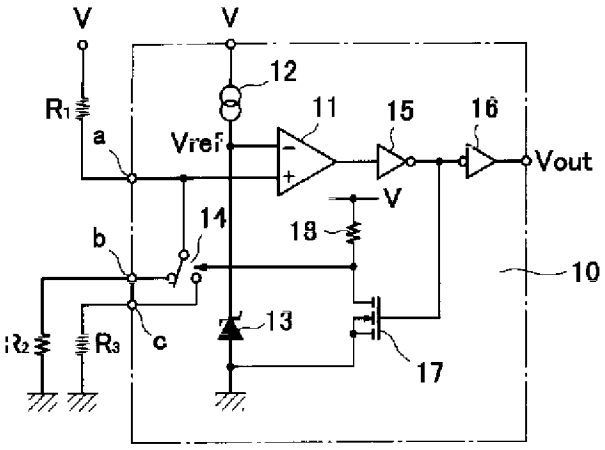
(54)【発明の名称】　二次電池の電圧検出装置および二次電池装置

(57)【要約】

【課題】　二次電池に応じたシャットダウン検出電圧と復帰検出電圧とを簡易に設定可能な集積回路化された電圧検出装置を提供する。

【解決手段】　二次電池の電池電圧を所定の分圧比で分圧する分圧抵抗と、この分圧抵抗を介して求められる検出電圧と所定の基準電圧とを比較する比較器と、この比較器の出力に応じて前記分圧抵抗の分圧比を変更して前記比較器にヒステリシス特性を付与する分圧比制御手段とを備え、特に前記分圧抵抗を、前記比較器および分圧比制御手段を主体として集積回路化される電圧検出装置本体に対して外付けされるディスクリート部品とし、その抵抗値を簡易に調整し得るようにする。また集積回路化する電圧検出装置本体を種々仕様の二次電池に対して共用化することを特徴とする。



【特許請求の範囲】
【請求項１】　二次電池の電池電圧を所定の分圧比で分圧する分圧抵抗と、この分圧抵抗を介して求められる検出電圧と所定の基準電圧とを比較する比較器と、この比較器の出力に応じて前記分圧抵抗の分圧比を変更して前記比較器にヒステリシス特性を付与する分圧比制御手段とを具備し、
前記分圧抵抗を、前記比較器および分圧比制御手段を主体として集積回路化される電圧検出装置本体に対して外付けされるディスクリート部品としたことを特徴とする二次電池の電圧検出装置。
【請求項２】　請求項１に記載の二次電池の電圧検出装置を、該二次電池と一体にパッケージ化してなることを特徴とする二次電池装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、集積回路化されて種々仕様の二次電池の充電電圧を検出するに好適な二次電池の電圧検出装置と、この電圧検出装置を二次電池と共にパッケージ化した二次電池装置に関する。
【０００２】
【関連する背景技術】近時、ノートブック型パーソナル・コンピュータや携帯電話機等の電子機器における内部電源として、リチウムイオン電池やニッケル水素電池等の二次電池が盛んに用いられるようになってきた。また最近では二次電池の充放電を制御するフュエルゲージ（ＦＧ）回路を該二次電池と一体にパッケージ化した二次電池装置が、所謂電池パックとして種々開発されている。
【０００３】この種のフュエルゲージ回路における重要な機能の１つに、二次電池の充電電圧を監視することで、該二次電池の過度な充放電防止対策に利用される電圧検出装置がある。この電圧検出装置は、基本的には二次電池の充放電電圧がシャットダウン電圧に至ったとき、これを検出して前記二次電池の充放電を制御するスイッチ（例えばＦＥＴ）をオフ動作させ、これによって該二次電池の過剰な充放電を防止する役割を果たす。
【０００４】ちなみに二次電池が上記シャットダウン電圧から回復したとき、これをシャットダウンと同じレベルで検出するようにすると、前記充放電制御用のスイッチのオン動作に伴って前記二次電池が再びシャットダウン電圧に戻る虞がある。これ故、前記電圧検出装置には、一般的にシャットダウン検出電圧と復帰検出電圧とに差を持たせて前記二次電池の充放電電圧を検出するように、つまり所定幅のヒステリシスを有する電圧検出特性が設定される。
【０００５】
【発明が解決しようとする課題】ところで二次電池と共に上述した電圧検出装置を一体にパッケージ化して二次電池装置（電池パッケージ）を実現する場合、その信頼性や実装コスト等の観点に立脚すると、前記電圧検出装置を集積回路化することが望ましく、例えば図４に示す如く回路構成されて集積回路化される。
【０００６】この図４に示す電圧検出装置について説明すると、この電圧検出装置は二次電池の電池電圧Ｖbatを電源として作動する比較器１を主体として構成される。そして比較器１の反転入力端子(－)に定電流源２および定電圧ダイオード３にて前記電池電圧Ｖbatから生成される基準電圧Ｖrefを与えると共に、直列に接続された分圧抵抗Ｒ1,Ｒ2,Ｒ3にて前記電池電圧Ｖbatを分圧した比較電圧を前記比較器１の非反転入力端子(＋)に与えることで前記電池電圧Ｖbatを監視し、これを比較検出するものとなっている。
【０００７】ちなみに上記比較器１は、その出力にて電源間に直列に接続して設けられてドライバ回路をなすｎチャネル型ＦＥＴ４とｐチャネル型ＦＥＴ５とを択一的に導通させ、これによって出力用のｐチャネル型ＦＥＴ６をオン・オフさせる如く構成される。同時にその出力にてヒステリシス制御用のｐチャネル型ＦＥＴ７をオン・オフさせ、これによって前記分圧抵抗Ｒ3を選択的に短絡させることで前記電池電圧Ｖbatに対する分圧比を変化させるものとなっている。
【０００８】ところでこのようにして集積回路化される電圧検出装置においては、その動作特性である前述したシャットダウン検出電圧とその復帰検出電圧、ひいてはヒステリシスの幅が前記分圧抵抗Ｒ1,Ｒ2,Ｒ3の値によって自ずと決定される。しかしながら二次電池に最適なシャットダウン検出電圧とその復帰検出電圧は、二次電池の特性によって異なる。特に二次電池はその仕様に応じて電池種別が決定されることのみならず、単一の電池セル（素電池）として実現さたり、或いは複数の電池セルを直列に、更には並列に接続した電池ブロックとして実現される。これ故、二次電池の仕様に応じた動作特性の集積回路化された電圧検出装置を個々に開発したり、或いは動作特性の異なる集積回路化された複数種の電圧検出装置を予め準備しておき、これを選択して用いる必要があり、電圧検出装置を集積回路として共用化することが困難であった。
【０００９】本発明はこのような事情を考慮してなされたもので、その目的は、種々仕様の二次電池に応じてそのシャットダウン検出電圧と復帰検出電圧とを簡易に設定可能な集積回路化された電圧検出装置を提供することにある。また本発明はこのような電圧検出装置を二次電池と一体にパッケージ化した動作安定性の高い二次電池装置を提供することにある。
【００１０】
【課題を解決するための手段】上述した目的を達成するべく本発明に係る二次電池の電圧検出装置は、上記二次電池の電池電圧を所定の分圧比で分圧する分圧抵抗と、この分圧抵抗を介して求められる検出電圧と所定の基準

電圧とを比較する比較器と、この比較器の出力に応じて前記分圧抵抗の分圧比を変更して前記比較器にヒステリシス特性を付与する分圧比制御手段とを備えたものであって、特に前記分圧抵抗を、前記比較器および分圧比制御手段を主体として集積回路化される電圧検出装置本体に対して外付けされるディスクリート部品としたことを特徴としている。

【００１１】また本発明に係る二次電池装置は、上述した如く構成される電圧検出装置を、種々の仕様の二次電池と一体にパッケージ化し、該二次電池の性能に応じたシャットダウン検出電圧と復帰検出電圧とを設定してなることを特徴としている。即ち、本発明は、比較器および分圧比制御手段を主体として集積回路化される電圧検出装置本体に対して、二次電池に対するシャットダウン検出電圧および復帰検出電圧を設定する為の分圧抵抗を外付けのディスクリート部品とすることでその抵抗値を簡易に調整し得るようにし、集積回路化する電圧検出装置本体を種々仕様の二次電池に対して共用化したことを特徴としている。

【００１２】

【発明の実施の形態】以下、図面を参照して本発明の一実施形態に係る二次電池の電圧検出装置について説明する。図１は二次電池のシャットダウン電圧とその復帰電圧を検出する為の電圧検出装置の概略構成図で、R1,R2,R3は上記二次電池の電圧Vbatを分圧して検出する分圧抵抗である。これらの分圧抵抗R1,R2,R3は、以下に示す用に証跡回路化される電圧検出装置本体１０に対して外付けされるディスクリート部品からなり、該電圧検出装置本体１０が搭載される回路基板（図示せず）に装着されて該電圧検出装置本体１０に接続される。

【００１３】さて前記電圧検出装置本体１０は、二次電池の電池電圧Vbatを電源として作動する比較器１１と、この比較器１１の出力に応じて前記分圧抵抗R1,R2,R3による電池電圧Vbatの分圧比を変化させて前記比較器１１の動作特性にヒステリシスを付与する分圧比制御手段とを主体として構成され、これらを集積回路化して実現される。即ち、比較器１１は、その反転入力端子(－)に定電流源１２および定電圧ダイオード１３にて前記電池電圧Vbatから生成して基準電圧Vrefを入力し、前記分圧抵抗R1,R2,R3にて前記電池電圧Vbatを分圧した検出電圧をその非反転入力端子(＋)に入力し、これらの電圧を比較する如く構成される。

【００１４】ちなみに前記分圧抵抗R1,R2,R3は、電圧検出装置本体１０に設けられた抵抗接続用の端子ａ，ｂ，ｃにそれぞれ接続されるもので、上記端子ａは前記分圧比制御手段を構成するスイッチ１４の共通接点に、また前記端子ｂ，ｃは上記スイッチ１４の常閉接点および常開接点にそれぞれ接続されている。尚、このスイッチ１４は、例えば前記比較器１１よりも高速にスイッチング動作する半導体アナログスイッチとして実現される。しかして前記分圧抵抗R1は前記端子ａと二次電池の正極(＋)との間に接続され、また前記分圧抵抗R2,R3は前記各端子ｂ，ｃと上記二次電池の負極(－)との間にそれぞれ接続される。

【００１５】このようにして前記各端子ａ，ｂ，ｃに前記分圧抵抗R1,R2,R3をそれぞれ接続することで、前記スイッチ１４のオフ動作時には、前記二次電池の電池電圧Vbatが

$V1 = Vbat \{R2/(R1+R2)\}$

として検出され、また前記スイッチ１４のオン動作時には

$V2 = Vbat \{R3/(R1+R3)\}$

として検出されるようになっている。尚、上記分圧抵抗R2,R3は、例えば後述するように［R2＞R3］として設定される。

【００１６】しかして前記比較器１１の出力は、２段のインバータ回路１５，１６を順に介して電圧検出信号Voutとして出力され、例えば図示しない充放電制御回路等に与えられる。また上記インバータ回路１５の出力は、前記スイッチ１５を選択的に駆動するｐチャネル型のＦＥＴ１７に与えられて該ＦＥＴ１７を作動させており、該ＦＥＴ１７によって前記スイッチ１５が選択的にオン・オフ駆動されるようになっている。尚、図中１８は上記ＦＥＴ１７の負荷抵抗である。

【００１７】かくしてこのように構成された電圧検出装置によれば、二次電池の電池電圧Vbatがそのシャットダウン電圧よりも十分に高い場合（初期状態）、例えば比較器１１の出力が[H]レベルとなり、これによって前記スイッチ１４がオフ動作状態にあるとする。この場合には、前記スイッチ１４を介して前記分圧抵抗R2が選択された状態にあるので前記二次電池の電池電圧Vbatは、分圧抵抗R1,R2により分圧されて前述した検出電圧V1として比較器１１の非反転入力端子(＋)に与えられる。このときの検出電圧V1は前記基準電圧Vrefよりも高いことから前記比較器１１の出力が[H]レベルとなり、前述した初期状態が設定される。

【００１８】このような初期状態から前記二次電池の放電に伴ってその電池電圧Vbatが次第に低下し、前記分圧抵抗R1,R2により分圧されて検出される電圧V1が前記基準電圧Vrefを下回ると、これによって前記比較器１１の出力が反転して[L]レベルとなる。するとこれを受けて該電圧検出装置本体１０の出力Voutが[L]レベルに反転し、前記二次電池の電池電圧Vbatがそのシャントダウン電圧を下回ったことが検出される。また同時にインバータ回路１５の出力を受けたＦＥＴ１７がオン動作するので、これによって前記スイッチ１４が速やかに切り換えられてオン動作する。

【００１９】このようなスイッチ１４のオン動作に伴って今度は前記電池電圧Vbatが分圧抵抗R1,R3により分圧され、検出電圧V2（＜V1）として前記比較器１１に

与えられる。従って前記検出電圧Ｖ1が基準電圧Ｖrefを下回って比較器１１が反転動作すると、その出力を受けてスイッチ１４が瞬時に切り替わり、上記検出電圧Ｖ1に代えて該検出電圧Ｖ1より値低い検出電圧Ｖ2が比較器１１に与えられることになるので、比較器１１は上記の如く出力を反転した状態で安定する。

【００２０】しかる後、二次電池の電池電圧Ｖbatが次第に回復し、その電池電圧Ｖbatが前記シャントダウン電圧に達したとしても、前述した如くスイッチ１４がオン動作状態にあるので前記比較器１１の非反転入力端子(＋)に加わる検出電圧Ｖ2は前記基準電圧Ｖrefを上回ることがなく、比較器１１は反転動作することがない。しかし二次電池の電池電圧Ｖbatが更に回復し、前記分圧抵抗Ｒ1,Ｒ3により分圧されて検出される電圧Ｖ2が前記基準電圧Ｖrefを上回ると、この時点で前記比較器１１が反転動作し、その出力が〔Ｈ〕レベルとなる。

【００２１】この結果、電圧検出装置本体１０の出力Ｖoutが〔Ｈ〕レベルに反転し、前記二次電池の電池電圧Ｖbatが正常値に復帰したことが検出される。また同時にインバータ回路１５の出力により前記ＦＥＴ１７がオフ動作するので、これによって前記スイッチ１４が速やかに切り換えられてオフ動作する。そして前記分圧抵抗Ｒ3に代えて再度前記分圧抵抗Ｒ2が回路接続され、これらの分圧抵抗Ｒ1,Ｒ2により分圧して検出される検出電圧Ｖ1が前記比較１１に与えられて、前述した如く二次電池の電池電圧Ｖbatのシャントダウン電圧を越える低下の検出が行われることになる。

【００２２】従って上述した如く構成された電圧検出装置によれば、図２にその動作遷移を示すように二次電池の電池電圧Ｖbatの変化を、分圧抵抗Ｒ1,Ｒ2,Ｒ3による電源電圧Ｖbatの分圧比を比較器１１の出力に応じて簡単に切り換えることで、シャットダウン検出電圧と復帰検出電圧とを個別に設定し、所定幅のヒステリシスを持たせて検出することができる。特に分圧抵抗Ｒ1,Ｒ2,Ｒ3による電池電圧Ｖbatの分圧比は、電圧検出装置本体１１に対して外付けされるディスクリート部品の抵抗値として個別に設定することが可能なので、二次電池の性能に応じて調整することが可能であり、その電圧検出レベル（シャントダウン検出電圧，復帰検出電圧）を任意に設定可能である。

【００２３】これ故、二次電池装置（電池パック）を実現するに際して、二次電池の仕様が定まらないような場合であっても、予め上述した構成の集積回路化された電圧検出装置本体１０を準備しておき、最終的に評価・決定された二次電池の特性に応じて前記電圧検出装置本体１０に外付けされる分圧抵抗Ｒ1,Ｒ2,Ｒ3を決定すれば良いので、該二次電池装置（電池パック）の開発が非常に容易となる。またその開発期間の大幅な短縮を図り得る。更には種々仕様の二次電池に対して上記の如く集積回路化された電圧検出装置本体１０を共通に用いることができるので、種々構成（特性）の電圧検出装置本体１０を準備する必要がなく、また電圧検出装置本体１０事態の開発も容易化し得るので、全体的な製造コストの低減を図ることができる等の効果が奏せられる。

【００２４】また上述した構成であれば、分圧抵抗Ｒ1,Ｒ2,Ｒ3が電圧検出装置本体１０に対して外付けされるので、例えば二次電池の充電時および放電時に応じて外付け抵抗の値を変え、これによって充電時の検出電圧とそのヒステリシス幅、また放電時の検出電圧とそのヒステリシス幅とを別個に設定することが可能である。具体的には二次電池が充電状態であるか放電状態であるかに応じて、例えば前記分圧抵抗Ｒ2,Ｒ3に対してそれぞれ抵抗Ｒ4,Ｒ5を選択的に並列接続したり、或いは上記抵抗Ｒ2,Ｒ3と抵抗Ｒ4,Ｒ5とを選択切り替えするようにしても良い。このようにすれば充電時の電圧検出用と、放電時の電圧検出用との２つの電圧検出装置を準備する必要がなくなるので、以下に示すように二次電池装置（電池パック）を実現する場合、その構成の簡易化を図ることが可能となる。

【００２５】ちなみに上記構成の電圧検出装置を二次電池と一体にパッケージ化して二次電池装置（電池パック）を実現する場合には、例えば図３に示すように構成するようにすれば良い。即ち、二次電池ＢＡＴに対して、その充放電を制御するパワーようＦＥＴからなるスイッチ２１と、充放電電流検出用の抵抗２２とを直列に接続する。また二次電池ＢＡＴの内部を温度を検出する温度センサ２３と共に、フュエルケージ回路２４やその動作を制御するマイクロプロセッサ２５、更に前述した電圧検出回路１０を一体にパッケージ化して二次電池装置（電池パック）を構成するようにすれば良い、尚、前記フュエルケージ回路２４は、例えばパワースイッチ回路２４ａや電流計測回路２４ｂ、電圧計測回路２４ｃ、過電流保護回路２４ｄ、およびスイッチドライバ２ｅ等を具備して構成される。そして前記温度センサ２３により検出される電池温度を、マイクロプロセッサ２５に内蔵されたＡＤ変換器２５ａを介して取り込みながら、二次電池ＢＡＴの充放電電流やその電池電圧を計測し、電池残容量をモニタしながらその充放電を制御するように二次電池装置を構成すれば良い。この際、前記電圧検出装置１０は、その出力にて上記フュエルケージ回路２４やマイクロプロセッサ２５の作動を制御して、その安定した動作を保証する役割を果たす。

【００２６】この際、上記フュエルケージ回路２４にて検出される電流の向きによって二次電池が充電中か、或いは放電中かを判定することができるので、その判定結果を用いて前述した抵抗の切り替え制御を実行するようにすれば、前述したように１つの電圧検出装置だけで二次電池の充放電に応じた電圧検出を確実に行うことが可能となる。

【００２７】尚、本発明は上述した実施形態に限定され

るものではない。例えば電圧検出装置本体１０を構成する比較器１１の構成や、分圧抵抗R1,R2,R3に対する分圧比制御手段の構成は、種々変形可能である。例えば分圧抵抗R1,R2,R3を互いに並列接続して、その分圧比を代えるように構成することも勿論可能である。また予め所定抵抗値の分圧抵抗R1,R2,R3を内蔵しておき、これらの内蔵した分圧抵抗に対してた外付けの抵抗を直列に、或いは並列に接続し得るように構成することも可能である。その他。本発明はその要旨を逸脱しない範囲で種々変形して実施することができる。その他、本発明はその要旨を逸脱しない範囲で種々変形して実施することが可能である。

【００２８】

【発明の効果】以上説明したように本発明によれば、二次電池の電池電圧を分圧抵抗にて所定の分圧比で分圧して求められる検出電圧を比較器において所定の基準電圧と比較すると共に、この比較器の出力に応じて前記分圧抵抗の分圧比を変更して前記比較器にヒステリシス特性を付与する分圧比制御手段を備え、前記分圧抵抗を、前記比較器および分圧比制御手段を主体として集積回路化される電圧検出装置本体に対して外付けされるディスクリート部品としているので、上記分圧抵抗を調整するだけで種々仕様の二次電池に対するシャットダウン検出電圧および復帰検出電圧を簡易に設定することができる。

【００２９】特に集積回路化される電圧検出装置本体を種々仕様の二次電池に対して共用化し得るので、電圧検出装置と二次電池と一体にパッケージ化した二次電池装置の開発を容易化し、安価に製作することができる等の実用上多大なる効果が奏せられる。

【図面の簡単な説明】

【図１】本発明の一実施形態に係る二次電池の電圧検出装置の概略構成図。

【図２】図１に示す電圧検出装置の電池電圧Vbatの変化に対する動作特性を示す遷移図。

【図３】図１に示す電圧検出装置と二次電池とを一体にパッケージ化して構成される二次電池装置（電池パック）の概略構成図。

【図４】従来の集積回路化された電圧検出装置の構成例を示す図。

【符号の説明】

ＢＡＴ　二次電池

R1,R2,R3 分圧抵抗（ディスクリート部品）

１０　電圧検出装置本体（集積回路化）

１１　比較器

１２　定電流源

１３　定電圧ダイオード（基準電圧）

１４　スイッチ

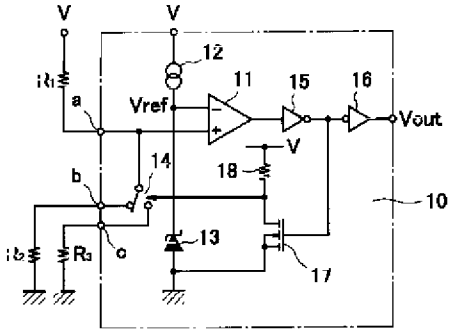
１５　インバータ回路

１６　インバータ回路

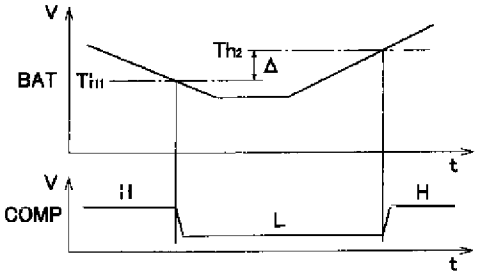
１７　ＦＥＴ

１８　負荷抵抗

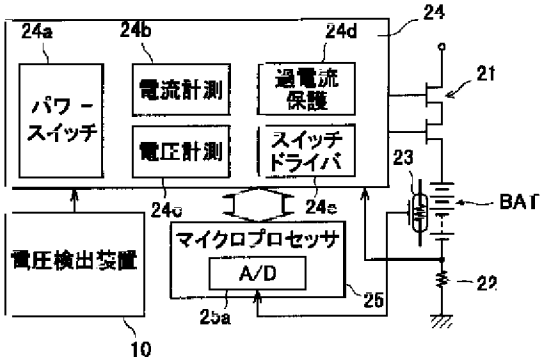
【図１】



【図２】



【図３】



【図４】